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Limitations of Frozen Storage for Fruits and Vegetables

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CAN housewives safely and satisfactorily use the frozen-storage method of keeping fruits and vegetables? This question has lately come to the fore since the locker system of cold storage for meats has been introduced into many Minnesota localities. To anyone who will carefully study all sides of the problem it will be quite clear that the average housewife should not attempt the frozen pack for fruits and vegetables.

Hotels, public institutions, dining cars, and ship companies which use the frozen-pack method of storing fresh fruits and vegetables are equipped with efficient refrigerators that insure the handling of frozen foods from packer to consumer always in the hard frozen condition. To avoid bacterial and fungus spoilage, there must be no thawing whatever of these frozen-packed foods. In commercial freezing, there is a large enough volume of the pack to warrant thorough inspection and control. Furthermore, their refrigerating equipment is large enough and so arranged as to insure quick freezing in the container, which is essential to prevent spoilage of the innermost contents before actual freezing takes place.

The fact that a family supply of meat can be kept successfully in a small cold-storage locker

does not mean that the frozen storage of fruits and vegetables by housewives will prove satisfactory. In general, the frozen storage of meats offers less difficulty from the sanitary standpoint than that of fruits and vegetables. The way in which meats are prepared makes them less liable to be contaminated by soil bacteria and fungi or by those introduced in handling. Nearly all fruits and vegetables are thoroughly covered by fungus spores and bacteria, and if the products have been bruised or cut in picking or handling, the spoilage organisms may be present on the inside as well. The usual washing of small fruits, while it removes sand and dirt, thoroughly covers the fruit with these spoilage organisms which will become active under the first favorable conditions.

Bacteria Survive Freezing

The spores of bacteria and fungi are not all killed either by hot blanching or by freezing, and in many cases the growing micro-organisms are not killed. Several bacteria are able to withstand boiling temperatures, or even the temperature of pressure cookers, and can produce spoilage later. Such bacteria are not all killed in ordinary canning and would grow if the canned product contained air. The best canning treatment removes oxygen of the air from the cans, but in present frozen-pack methods, oxygen is not removed, and when the temperature rises, the organisms start growing and soon spoil the food.

If yeasts grow in thawed material, they may produce an alcoholic taste; fungi produce a soured taste, but the dangerous Botulinus bacteria may give no warning by odor or appearance.

Fruits and vegetables also contain substances that combine directly with oxygen of the air, causing changes in flavor and color. For this reason, strawberries and peaches are notably dif-

ficult to handle in frozen pack. Acid berries, sour varieties of strawberries, and rhubarb are less difficult. Hot blanching of products before freezing may partly overcome this difficulty.

It can easily be seen from the above discussion that the preparation and handling of the frozen pack is not simple, and, in fact, may involve more equipment and greater care than the usual canning methods. Furthermore, frozen-packed materials can be stored safely only for a short time as compared to properly canned foods that will keep for many years. Any gains made by buying fresh products at the height of their harvest when they may be cheaper than canned goods will be more than offset by the rental of lockers for such bulky products.

Since lockers must permit free circulation of the cold air through them, frozen foods are liable to change of flavor due to the absorption of odors from other products stored in the room, such as fish, game, poultry, cheese, onions, and cabbage.

Fruits and vegetables that are to be stored in frozen pack must be completely prepared for serving before they are frozen. The thawed material is soft and cannot be further handled to clean it. All such plant materials contain so much water that juice will be lost unless tight glass, tin, paper, or wooden containers are used for storage. Every operation required in preparation for canning must be performed for frozen packing, and, in addition, greater care must be used to avoid contamination, because typhoid bacteria and other disease organisms may not be killed in frozen-pack methods.

Hot blanching of plant materials for a few minutes at 160° F. usually is enough to destroy the action of the enzymes that produce flavor and color changes. Partial killing of bacteria on the surface of products also may be accomplished by this means, and the vegetable color preserved.

Paper or Wood Containers Best

The containers for frozen pack must not be liable to breaking by expansion of the freezing contents. For this reason, glass is not satisfactory. Tinned iron containers will bulge if filled full. Also, red raspberries and strawberries will turn blue if they come in contact with areas of the can where the enamel is cracked or broken. This may also result in an abnormal flavor.

Paraffined paper cartons are inexpensive and are not subject to breaking or to the defects of tinned containers. A paraffine coating prevents the frozen materials from absorbing any considerable flavor from the paper itself or from glue, sizing, or other substances used in carton manufacture. Likewise, the paraffine prevents the frozen product from absorbing any odors that may be in the refrigerator if meats, cheese, etc., are stored in the same lockers, or nearby. Cartons should not have iron staples or tinned ends because these generally will rust.

The most satisfactory container material for frozen packing is wood. Wooden pails, kegs, or barrels are used most successfully for commercial frozen pack, but are usually so large as to make them impractical for family use. The kegs or barrels should be made of maple or other woods that will not produce a flavor in the frozen material. They should be impregnated with a paraffine that is soft enough so that it will not crack when cold or flake off into the food.

Bulging or breaking from freezing can be prevented by packing berries with enough dry sugar to make a suitable sirup when it dissolves in the juice. Sugaring or adding sirup is desirable also to decrease changes due to oxygen.

Fruits and vegetables that are to be frozen packed to retain their fresh flavor should be prepared as soon as possible after picking. At the

usual summer temperature, peas, snap beans, etc., will within a few hours lose most of their sugars through their normal respiration. After 12 hours practically all of the sugar has been respired out of these vegetables. Thereafter, other materials are used in respiration, thus causing additional changes of flavor. Refrigerated storage at near the freezing point immediately after picking decreases these changes.

Temperatures for Freezing and Storage

The containers must be small enough so that the refrigeration used will lower the temperature of the contents to 15° F. within three or four hours. If this cannot be done with the coldest refrigeration available, the size of container must be reduced. When 15° F. has been reached, the danger of bacterial spoilage is past, but it is necessary to drop the storage temperature to 0° F. to stop flavor and color changes due to oxidation. This 0° F. temperature must be held during the whole period of storage. If the temperature should rise to 20° F., fungi such as Botrytis will begin to grow. Even short periods of temperature up to 15° F. will allow oxidation and change of flavor and color in fruits.

At 0° F. bacteria and fungi do not grow, but they remain alive and ready to grow as soon as the material thaws. The plant juices are an ideal culture medium for many bacteria, yeasts, and molds. If the frozen food is placed in an iced refrigerator, its temperature will be above the freezing point and frequently 40-50° F. At these temperatures spoilage quickly occurs, for the freezing will have destroyed the natural defensive mechanisms of fruits that prevent the infection.

Yeasts and molds most commonly produce spoilage of the acid fruits and vegetables. Bacteria that produce food poisons (commonly called

ptomaine poisoning) must be especially guarded against in frozen peas, asparagus, and snap beans. It is possible for typhoid bacteria and other disease organisms of mankind to live in the frozen pack and to multiply after it is thawed. The food that is to be served uncooked should not be allowed to stand after thawing for more than four hours unless enough sugar or sirup is present to preserve it. Peas, asparagus, and snap beans should be cooked thoroughly and not put directly into salads. Cooking will tend to decrease the danger from bacterial food poisoning because it will kill the bacteria of botulism. Thorough cooking also destroys the toxins that may have accumulated in these vegetables due to careless handling or neglected storage temperatures. If frozen-packed food must be kept for longer than four hours before it is consumed, it is best to refreeze it in the freezing compartment of the mechanical refrigerator, or to cook it.

The U. S. Department of Agriculture reports experiments which indicate that there is apparently no danger of food poisoning from vegetables and fruits that are frozen in brine or sirup and stored at 0° F., provided these products are eaten within 48 hours after thawing. Boiling the vegetables for 10 minutes or longer would tend to destroy food toxins present.

However, from all the precautions that must be taken, any housewife will see at once that it would be easier and less dangerous to sterilize food by canning it instead of using frozen-pack methods. The average household simply is not equipped to prepare and care for frozen-packed products properly. Neither does the average creamery, storage house, or meat distributor have suitable equipment.

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